EVALUATION OF FACILITIES

FOR

HANDLING AND STORING GRAINS

EL SALVADOR, CENTRAL AMERICA

NOVEMBER 1972

Economic Research Service
U.S. Department of Agriculture
Cooperating with U.S. Agency for
International Development

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HAROLD B. STRYKER
GRAIN STORAGE SPECIALIST

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PREPARED BY	Harold B. Stryker Rising City, Nebraska 68658

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INTRODUCTION

Various studies and projections have been made regarding the agricultural economy of El Salvador and the problems related to increasing production to increase farmer income while lowering consumer food costs. Many of these allude to wide price fluctuations each year.

To promote production without adequate compensation to the producer may discourage him from producing and may entirely destroy a market. At the same time unrealistic support or fixed high prices to a producer may create a situation whereby the gross support is in excess of what a government can pay. This could also create excessive production with inadequate facilities for placing a commodity in the market in an orderly fashion.

If a government intends to assert some control in the price structure or commodity quality, it must have the marketing structure and facilities to do so. This means quality control and facilities to store a commodity until it moves into a market. Even if a government intends to support a commodity at a given price and the private sector purchases the commodity at a price above the support, the government facilities would still have accomplished their intended purpose of developing fair prices and adequate production to the private sector. If a government does not intend to be the sole purchaser of a commodity, though, it should be cautious of capital investments. There could be periods of non-use when a commodity is moving to the consumer through private marketing facilities.

The Government of El Salvador, through the Instituto Regulador de Abastecimientos (IRA), has made the decision to effect a stabilized price on certain grain and bean crops. The following report based on an October-November 1972 U.S. Department of Agriculture study sponsored by the U.S. Agency for International Development makes recommendations for improving El Salvador's overall grain handling activities. It then evaluates existing physical facilities at San Martin and Usulutan and proposed facilities at buying stations to determine how they can be improved or expanded to assist the IRA in its endeavor.

GENERAL RECOMMENDATIONS

El Salvador has capable design engineers and companies to install and alter grain handling equipment. In my observations, the workmanship is excellent. Someone with grain handling experience working with a design engineer from El Salvador could make improvements in the overall grain handling system, however. Some basic suggestions follow.

PURCHASING EQUIPMENT

El Salvador has an extensive electrical power grid transmission system and, at locations, power can be reduced to 115, 220, and 440 volts. In some remote areas, three-phase electricity may not be available; therefore, if a three-phase line is required, the cost of extending a line should be considered or the grain handling facilities placed near a three-phase line.

All electricity from the system is 60 HZ (cycles). When purchasing motors or selecting equipment, it is important to consider a 60 HZ electric motor which will operate at RPM's in multiples of 1725 (50 HZ motors operate in multiples of 1500 RPM). Motors should be selected which will tolerate lower voltages than the voltage specified as being available, as there may be other demands for power besides the grain facility which could lower the power voltage at certain locations. This would result in extensive damage to the facility motors if they were not tolerant to this lower voltage.

In alterations or new construction, every effort should be made to standardize equipment so parts can be more readily available and repairs made easily. All new machinery should be as simple and practical as possible. Machinery or equipment should be purchased from a manufacturer that will be able to provide service and quickly obtain repairs. If satisfactory equipment is available within El Salvador, it should be utilized. If equipment or machinery is purchased from another country, the manufacturer should print instructions in Spanish for installation and maintenance. The manufacturer should be required to provide an installation engineer, start operation and guarantee performance.

BULK HANDLING

Any alterations made should be made to produce a superior product and to use men and machines more effectively and efficiently. One area that should receive more consideration, then, is bulk handling of grain, both within facilities and within the country. Bulk handling saves the time and expense of bagging and the opening of bags at the receiving point. Every effort should be made to store as much of the grain in bulk as facilities will allow. Only a reasonable quantity

of grain should be placed in bags to serve current transportation demands or customers who cannot handle bulk grain.

Grain stored in bulk can be easily fumigated, aerated, and moved, if necessary, for re-drying. If grain is stored in the bag, it may become infested with insects or absorb moisture and develop mold, which is difficult to detect. If a roof should leak, spoiled grain will result, which may not be discovered until a bag is opened. Handling grain in bulk makes it possible to obtain a dependable sample to reveal the quality and condition. The maintenance of quality is exceedingly important and serious, and can be handled with more success in properly equipped bulk storage.

Damp grain promotes the growth of insects and fungi. The fungi are the cause, not the result, of grain spoilage. Damp, unsanitary grain, infested with insects, promotes the growth of fungi. If fungi are allowed to reproduce, it is possible to have a rapid multiplication of an Aspergillius flavus, which produces toxins called aflatoxins. Only a few parts per billion can cause pathological changes in animals that are susceptible to aflatoxins. For this reason, grains containing detectable mold or fungi should not be used for human or animal consumption. Tests for toxins are very difficult; therefore, the remedy is to prevent conditions conducive to the production of fungi. Again, it is being stressed that grain and beans should be stored in bulk to the extent possible to maintain safe moisture levels and insect control through adequate aeration and insect control methods and equipment. A SUPERIOR PRODUCT WILL BUILD PRESTIGE FOR MANAGEMENT AND THE GOVERNMENT.

In many countries, nearly all grains have historically been bought, sold, and handled in bags. As a result, it was only natural that, when storage facilities were first constructed, grain was stored in the bag. At the storage site an unloading dock was usually constructed to the approximate height of the vehicles to be unloaded. When mechanical equipment was first installed to place grain in the building as bulk, it was only natural to place the receiving pit on the unloading dock at a height above the ground level. Bags of grain were pulled from the vehicle, carried to the unloading dock, and the bag opened to dump the grain into a receiving device. It has been difficult to overcome this method of handling grain and to recognize the advantages of handling grain in the bulk.

GROUND LEVEL RECEIVING PITS

Alterations and new facilities should provide a receiving pit at ground level so bulk or bagged grain can be dumped directly into the pit. It may not be practical to install hydraulic lifts or mechanical truck lifts at this time in small facilities because of the abundance of labor. But, when planning for the future, it is a serious mistake not to place a receiving pit at ground level.

It is very cheap and easy to place small sliding doors in the bottom of a truck. These can be opened to allow the grain to flow into a receiving pit. With several sliding doors, approximately two-thirds of a load can be discharged into the pit; manual labor is then needed only to push the remaining grain to the openings in the floor of the truck.

If management were to experience bulk grain handling utilizing receiving pits at ground level, I am certain the principle would be readily accepted.

TEMPERATURE MONITORING

When storing grain in bulk, it is necessary to provide temperature gauges or thermocouples in the storage facility. Temperature monitoring is an absolute necessity if grain is to be properly maintained.

The color of the bins at the present time absorbs heat from the sun. I do not recommend that the present paint be removed from grain storage facilities, as this would be very costly. But, in the future, grain storage facilities should be painted white or aluminum to reflect the sun rays. The inside of a facility will be several degrees cooler during periods of sunshine if painted with a reflective paint. An asphalt-base paint containing aluminum flakes is available which can be used over the present paint.

RADIO COMMUNICATIONS SYSTEM

At the present time IRA has two-way radio equipment to the extent of a base station at the IRA office, a base station at San Martin, a base station at Usulutan, and one mobil unit.

Evidently, the radio is used very little, for the base radio at the IRA office was covered with books and papers and, I understand, the mobil unit does not work. If IRA must utilize radio communications for contact with their processing facilities and if additional radios in the trucks or autos are required, it will be necessary to replace the present radio equipment. At present, it is sometimes possible to communicate with San Martin, but never with Usulutan.

I did not have time to make a detailed study of facilities available or being used by other government agencies. But, from what I have learned, the Ministry of Agriculture is using a radio of a type that has a simplex system (one frequency) narrow band $\pm$ 5 Khz. I also understand that the Ministry of Agriculture has radio communications to many of the same areas where it would be desirable for the IRA to have communications. The system is based on the use of repeaters at specific high points on volcanos for required frequency propagation. The Ministry is using a system of transmitting on a frequency of 151.335 Mhz. and receiving on162.245 Mhz. This is a high band frequency (VHF) that is not greatly

interrupted by man-made static such as power line, nor is there a great deal of interference by storms.

If possible IRA could use the existing repeater of the Ministry of Agriculture only as "standby" or as a "channel No. 1." It would then be necessary to purchase new radios for IRA and a phone patch with San Martin, Usulutan, and, within the near future, a radio at San Miguel. These new radios would have to be equipped with two channels, one to operate in the frequencies of 151.335 Mhz. through the repeater of Ministry and No. 2 to be the private channel for IRA, operating in 151.945 Mhz. narrow band through a repeater (could be installed at El Cerro de Las Pavas or at the San Salvador volcano). IRA can get this repeater for about U.S. $1,250. This technique is less expensive than the purchase of a new set of crystals for the existing transceivers at the Ministry of Agriculture, which would cost $200 per radio. The purchase of mobil radios for dispatching trucks or allowing an official to have communications with any area should be determined from experience.

Grain storage facilities were constructed at San Martin in the 1950's. Although the facilities may be considered old, they have been well maintained. There is no reason why the storage and related facilities should not be capable of drying and storing grains for another 20 years or more. Much of the equipment is standard to the grain industry and can be repaired with the replacement of belts and the use of metal cutting and welding equipment. The complex has a well-equipped machine shop for repairs as well as wood and sheet metal fabrication.

If bagging is necessary for retail markets, San Martin could perhaps become the headquarters for such bagging of beans, both red and black. At present there is no satisfactory method for cleaning and sorting the beans at any location. If IRA is to produce a superior product, emphasis must be placed on cleaning and removing objectionable beans and foreign matter by use of screens and air separation plus a device or system for removing objectionable material and deteriorated beans not removed by the cleaners. Magnets should be installed to remove metal. Sometime it may also be advisable to install a machine for polishing beans.

The cleaning and bagging equipment is expensive and the process technical; therefore, it would be advisable to transport to San Martin all beans that are to be placed in small retail size bags. The beans could be transported in bags or bulk, held in bulk tanks with proper aeration, and bagged as needed under rigid specifications. The bagged beans could be transported by truck to the various market centers within the country or to export locations. The present method is not satisfactory.

At the time of my visit to San Martin in October and November, 1972, the complex appeared to have excess of manpower. I am aware there is an abundance of labor, and wages are not excessive; yet, some men were idle and there was unnecessary handling and movement of bags of grain. Such costs are important as it is the consumer who finally must pay for any inefficient operation.

As an example, the maize was being bagged at the rate of 12 quintals per minute (approximately 1200 pounds). The bags were taken by a cart to a sewing area. Bags were sewn by hand since they were made of heavy jute. The bag was then pulled to the edge of a loading dock (top photo, page 32),1/ placed on a man's back and carried about 3 meters, and then placed on a pallet for a lift truck. It was necessary for the lift trucks to wait before they could carry a few bags a great distance over a rough road to a distant warehouse (see photos on p. 35). Bags could be placed directly into

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1/ Photos begin on page 30.

a motor truck from the sewing operation or directly onto a pallet rather than on the man's back for an unnecessary few meters of transportation. Also, some bags of beans were stored in the conveyor area of the grain bins, a very difficult place for storage (bottom,p.32).

Sometimes the distance is too great to consider using a conveyor for transporting grain and the grain is transported in bags (see top photo on page 38). Therefore, a conveyor would have to be of a belt-type of sufficient size to handle large bags and installed so that it could be reversed. The amount of grain that should be moved to and from the locations would not warrant the capital cost of a conveyor. Instead, by keeping the area reserved as much as possible for maize, both in bulk and bags, the movement of maize from one area to another could be greatly reduced.

PRIORITY 1. Consolidate activities and functions in one area to efficiently utilize machines and manpower.

Both bulk and bag warehouses should be used for receiving, drying, cleaning, storing, and bagging maize in large bags. The emphasis should be on storing as much maize as possible in the bulk, however, for reasons given in previous sections.

A roof, approximately 30 meters by 30 meters could be added in the San Martin layout (see bottom photo, page 31). The clearance under the roof should be at least 5.25 meters in height, which will allow trucks to pass under the enclosure. The roof over the dump pit should be high enough to allow for future installation of a truck lift. The roof would not only provide protection for grain moving from the bagging area to the warehouse but would also make a storage area for bagged grain.

When a roof is constructed, a dump pit for bulk grain could be placed at ground level and bulk grain transferred to existing augers. There is an existing spout for loading trucks with bulk grain that would be under the enclosure. If the pit were installed, it would allow for the receipt of grain in bulk, for emptying bagged grain, and for moving bulk grain to and from other locations. The roof and the dump were discussed with the management and the Engineer of IRA, Carlos Valdes. Engineer Valdes estimated the cost of the roof and dump pit, including machinery, at $30,000 and $2,000 respectively.

PRIORITY 2. Close the public road running through the complex.

At present, it is nearly impossible to expand the bulk storage facilities because a public road runs between the two areas of the complex. I recommend that this road be closed so the area would be under IRA control. The photographs on page 34 show the function and construction, location of gates, and area that could be used if the road were closed. The road is hard surfaced from the main road to the gates of IRA; the road then becomes a trail to a housing area

and is used on occasions for automobiles that travel to a lake. There is another road at the other end of the complex (top photo, page 31). It may be possible for the government agencies involved to close the one road (top, p. 34) and slightly change the other (page 31) to accommodate automobile traffic.

If the road were closed and relocated, there would only be one entrance to the complex from the main road (p.34). Two existing gates could be eliminated, making it unnecessary for the watchmen and the traffic halting devices which stop or slow the machines passing from one area to another. Closing the road would also enhance security. The big advantage, however, would be that additional grain bins could be added, using existing conveyors, if additional bulk storage is required (see photos on page 33).

It is possible that the road (see top photos, pages 31 and 34) could be closed without the need for a payment from IRA since both the IRA and the public roads department are under the jurisdiction of the government.

PRIORITY 3. Utilize empty rice bins for beans.

At the time of my visit, some maize was being stored in the rice bins. If it is not necessary to store rice, or if a bulk rice storage bin is empty, it would be an ideal place to store beans in bulk. The bins are not high and, consequently, the beans would not be dropped a great distance when placed in bins.

The pre-cleaning facilities for rice might also be used for cleaning beans prior to storage, although this cleaning process would not be the ultimate cleaning process for beans. Again, I am stressing that, if at all possible, one area and facilities should be used for maize and another area for beans. There would be no cost involved.

PRIORITY 4. Use large warehouse only for commodities destined for re-bagging.

There is a new, large warehouse (see photo on p.38) that is used to bag and store bagged material. I would recommend that, if at all possible, only those bagged commodities that are to be ultimately cleaned and placed in smaller bags be placed or stored in the large warehouse. Construction of a new roof in the maize processing area should lessen the need to store bagged maize in the new warehouse. Also, dry milk will soon be stored in the warehouse and the area it now occupies can then be used for maize. If maize is stored in the warehouse in bags, it may be necessary to fumigate the maize; this can cause objectionable odors and possibly contaminate such foods as dry milk, sugar, salt, and beans. Maize storage also promotes the infestation of flying insects, which can contaminate such products as salt and sugar as it is being bagged. No cost is

involved, and operating costs should be reduced since there should be less transfer of maize from one area to another.

PRIORITY 5. Enclose the area used to bag sugar and salt.

The high humidity of ambient air causes condensation on facilities used for bagging. The wet sugar and salt does build up on certain parts of the machinery and, if the material breaks off, it can go directly into the bag. These chunks of sugar or salt, however small, may be objectionable to a consumer. Condensation makes cleaning of the machinery nearly impossible. A possible remedy would be to enclose the two bagging facilities that are used for salt and sugar by installing a wooden framework from the floor to the ceiling.

The framework could be covered with heavy transparent plastic sheets that are available in San Salvador. The enclosure does not need to be air-conditioned. There could be a dehumidifier installed in the appropriate size to remove enough moisture from the air to prevent the condensation. Sufficient bagged material could be placed in the enclosure by lift trucks at the end of a day by driving through an opening with the lift truck. After a sufficient amount of a commodity was in the enclosure, the opening could be closed. Bagged material would be discharged from the enclosure through small openings. If the air pressure were equalized with the ambient air, it should not be difficult to control the humidity within the enclosure. The enclosure would not be as satisfactory as it would be if it were c ompletely air-conditioned, but air-conditioning would require insulation and the cost would be excessive. Many companies manufacture dehumidifiers, but the cubic meters of space and the amount of moisture to be removed must be determined before purchasing a dehumidifier.

PRIORITY 6. Rearrange bagging facilities.

Although the priority should be high for cleaning and bagging beans, the priority was lowered since priorities six, seven, eight, nine and ten are all relative and would be accomplished as one project. It will be expensive and take at least 6 months from the time the project is started.

Four bagging machines have been installed in the extreme end of the warehouse (bottom photo, p. 40) each with a holding bin outside the warehouse (top photo, page 39). The present unloading conveyors will only allow for a holding bin to be used with one bagging machine (bottom, p. 39). Salt and sugar will not be placed in the existing bins; therefore, if not changed, two bins will not be used since there is no way of moving the grain from one bin to another. I would recommend that a new conveyor be installed to transfer grain from one bin to another (bottom photo, page 39).

PRIORITY 7. Install cleaning device for beans.

Beans, red and black, were being placed in 460 gram transparent plastic bags for sale to consumers. Sample bags were taken from the

bagging operation, and on two occasions I purchased a 460 gram bag of beans from IRA retail stores. The beans in the plastic bags are dirty, with a great amount of foreign material and spoiled beans. A housewife, an employee of IRA, was asked to separate the beans that she would use from one sample bag. The separated beans were weighed and the usable beans of that sample amounted to 80 percent. Other samples averaged 12 to 18 percent foreign material and spoiled beans.

The fact that the beans are dirty is not the fault of the management. There is no machine to properly clean the beans, but attempts were being made to clean them by hand; this is a slow and costly process for large quantities (bottom, p. 37). The goal should be to produce a superior product, free of dirt and spoiled beans, that has eye appeal to the customer, especially those beans placed in plastic bags. A cleaning device is required whereby screens can be changed for different sizes of beans and the air flow adjusted to suck or blow as much dirt, trash, and light worm eaten beans from the finished product as possible. A magnet should also be installed to remove any particles of metal that may have passed over the screen of the cleaner. It may be desirable to polish the beans. It will be necessary to pass the beans over a conveyor belt for hand sorting before the beans are placed in the transparent bags. This capability should be provided for at the time the cleaner is installed.

I am recommending that all beans to be placed in small bags be brought to San Martin; therefore, the cleaner and the process should be carefully selected and the facilities well-planned. It is difficult to make a drawing until the decision is made as to what type of a cleaner will be purchased, since the type of the machine will influence the design of the various conveyors and other equipment.

PRIORITY 8. Install a roof over existing tanks at the end of warehouse (top photo, page 39).

Four new grain bins have recently been installed. They have never been used, as it is difficult to fill the receiving pits of the elevators. Furthermore, beans and grain cannot be satisfactorily cleaned before placing them in the hopper bins. Two of the bins, #1 and #2, will not be used as previously discussed. If the bins are to be used, there will be some spillage of grain. The small hopper bins are not protected from the rain and, as shown in top photo, p. 40 , there is water standing at the base of the bins and in the receiving pits.

If utilization is to be made of the hopper bins, it is important to construct a roof over the bins, for the spilled grain will quickly mold and there is no way to keep water from the receiving pits. The roof was discussed with the management and Engineer Carlos Valdes. It would not be advisable to construct the roof until the complete plans are made for the installation of a cleaner, alteration of the conveyors, extension of the concrete dock, and a land fill to make the receiving pits on the same level with the floor and surrounding area.

PRIORITY 9. Extend the loading dock (bottom photo, p. 38).

The concrete platform or dock at the location of the four tanks and the long loading dock are the same level. It is recommended that the loading dock be extended to interconnect the dock to the dump pits of the hopper bins. This will give lift trucks access to the area from the warehouse to discharge material directly into the receiving pits, thus providing for transfer of grain in bulk.

PRIORITY 10. Land fill to allow for utilization of receiving pits.

Hard surfacing is planned for the area (see bottom photo on p. 35). Rather than hard surface the area at this time, it should be delayed until the decisions are made regarding the cleaner, roof, and alterations. If the fill were made of a compactable material to a level of the receiving pits, trucks could discharge bulk loads directly into the pits without further alteration of the pits. The pits are large and well constructed. If the area were filled, it would also be possible to place bulk storage tanks in that location for storing bulk beans. The fill is estimated at 1,500 cubic meters and Engineer Valdes estimated the cost of filling at U.S. $1 per cubic meter. When viewing the photo, notice that the ground level at the end of the concrete dock is nearly the same level as the proposed fill. In sny event, the hard-surfacing is not important until the facilities are ready to be utilized.

PRIORITY 11. Purchase dry milk bagging machine.

Although not in the intended scope of my study, I was asked to examine the machine that is used for bagging dry milk in small bags. The existing machine is too high to place in the air-conditioned room that has a ceiling height of 3 meters. If used as at present, it is necessary for the person holding the bag under the filling spout to sit on the floor. The machine is designed for bagging grains. It is necessary to clean the bagging machine after use with a chlorine solution, but the design of the machine makes this impossible.

A new machine should be purchased especially designed to bag dry milk in small bags of 200 to 800 grams. It should be easy to clean. Also, if available, it should not be in excess of 2 meters in height to eliminate the necessity of altering the existing room. The present machine could be altered to fit the room, but since it is not the type of machine that should be used, it would be more logical to purchase a new machine if large quantities of milk are to be bagged.

PRIORITY 12. Hard surface the road between the warehouses (see top photo, page 35).

At present, lift trucks move grain in bags from one warehouse to another. It is necessary to travel a part of the distance on a road that becomes muddy and very rough. The reason for the low priority is to delay the hard surfacing of the road until a decision is reached regarding the possibility of closing the public road. If the public road is closed,

the location of the hard surface area may change (bottom photo, page 35). At the time the road is hard surfaced, it may be wise to lengthen the ramp that is used by lift trucks to provide access to the warehouse and dock. At present, the slope is steep and, as shown by the photo, lift trucks that are heavily loaded have some difficulty going up the ramp (top photo, p. 36).

PRIORITY 13. Install an intercommunication system.

As shown by the layout of the San Martin complex, the facilities are extended in a long narrow rectangle. There is a manager's office for the entire complex, a laboratory in the main office, a manager of the grain facilities in the elevator, and a manager of the large bag warehouse. It would be desirable to have intercommunication, but I consider the priority low until the grain handling operations are consolidated and the facilities for storing and bagging dry milk are consolidated in one location. The intercommunication system should be wired rather than wireless, since there is no need for mobil communications. A talk-receive facility could be placed in the main office, laboratory, maize elevator, bagging operation, and large warehouse.

PRIORITY 14. Reorganize the commodity testing laboratories.

At present, there are three laboratories, one for salt, one for maize and beans, and one for rice and grain sorghums. The salt and the maize testing facilities are in the same building, but the rice and grain sorghum laboratories are in a different location. The salt and sugar should be kept separate. However, the grain and rice laboratories should be consolidated into one, because the same testing equipment is common to maize and grain sorghum; equipment such as scales and moisture testers are common to all. I considered the laboratories to be overstaffed and could see no reason why all grains could not be tested in the existing laboratory in the main office building.

I would recommend that the laboratory at San Martin be the main testing laboratory for all IRA facilities in El Salvador. It will be necessary to have grain testing equipment at other locations and moisture testing equipment at buying stations if grain is to be dried; however, inspectors from San Martin should periodically check other laboratories on quality of grain in storage and test various pieces of equipment.

If the San Martin laboratory were to be the main testing facility, then maize graded at other locations would be checked to assure uniform grain grading. I saw samples of corn at Usulutan that were called CAP 1 which were inferior to samples of CAP 1 at San Martin. In the future, it will be advisable for all countries in Central America to coordinate their grading as trade expands within Central America. If IRA were to take the lead in El Salvador of establishing standardized grading and testing, it is possible their efforts would result in more export trade.

In the future, privately-financed and privately-owned warehouses may be constructed to store grain for others. If this develops, it will be necessary to have government testing so that people storing their commodities in a warehouse can be assured of weight, quality, and grade, and that the grain is, in fact, at the warehouse in good condition. There should never be an occasion where IRA would obtain samples or exert control over a completely private on-farm grain storage facility unless requested to do so by the owner. The same is true concerning any other private grain handler, unless the grain is declared as being of a certain quality such as CAP 1, CAP 2, etc.

EVALUATION OF USULUTAN FACILITIES

The IRA grain handling and storage facilities are approximately 15 years old. The facilities have been and are being well maintained. As at San Martin, they will have many useful years of life with continued maintenance and improvements.

I recommend consolidating the various functions into one area so the grain is moved a shorter distance as well as bulk grain handling whenever possible. As recommended at other locations, all possible space should be used for bulk storage and, if necessary, it will be imperative to transfer grains in bulk to other locations, such as the proposed facility at San Miguel.

It would be more efficient to store beans in the bulk or move them to San Martin and, ultimately, have them bagged at that location. This would allow more space for storing maize at Usulutan as well as eliminating the need for duplication of bagging facilities.

PRIORITY 1. Alter the planned warehouse.

I have reviewed plans for the new bulk warehouse at Usulutan that is to be used for beans or maize. It is my understanding that the new facility, equipped with two elevator legs, would be used to receive maize and beans as they are brought to the facility. If this is correct, the new warehouse is to be used as a holding bin until the grain is dried. Very little grain should be held at high moisture levels, and it should be held in storage for only a few days. Since the floor space of the new warehouse would be large, it is possible that there could be a small amount of wet grain in the center that would not allow the facility to be used to capacity until all wet grain has been dried. Usulutan is especially critical because of the high heat and high humidity; therefore, wet maize should be dried to 12 percent moisure as quickly as possible and placed in storage where it can be aerated and periodically checked for quality.

I would recommend that the plans for the two receiving pits, elevated concrete docks, the two vertical elevators, the two overhead horizontal augers, and the roof over the receiving pits be cancelled. The conveyor used to fill the present round bins could be used to fill the entire building with dry grain and the unloading augers in the bottom so arranged to transfer grain directly into the two existing augers that unload the round bins. The building should have two unloading augers in the floor to match and be in a direct line with the existing augers. In the future it may be desirable to place a lengthwise partition in the center of the planned warehouse. If a partition were installed, there would be an unloading auger for each side. If one auger were used, it would still be necessary to have a Y division to match the existing augers that are to be utilized.

PRIORITY 2. Install new vertical elevator leg to replace the two that are planned (bottom photo, p. 42; top photo, p. 43).

The round bins are vertical and hopper-bottomed. I would recommend that the rice bagging facilities be immediately moved to the rice drying and storage area. This would allow installation of a vertical elevator leg with a large capacity receiving pit inside the present building that is used for bagging rice. The receiving pit should be at floor level and covered with a heavy iron grill to allow trucks to unload bulk grain by backing over the pit or to allow bags to be dumped into the pit. Since the building is large, bags of maize received could be held for several days in the bag inside the building before they were dumped into the pit for immediate transfer to the dryer. The elevator leg would discharge into two of the existing bins, one to be used for beans and the other for maize. Since the tanks would be used as wet grain holding bins, they could be quickly emptied if there were sufficient grain to fill the dryer.

The money saved by cancelling the present two concrete docks, the two conveyors, the two elevators, the two pits, and the two roofs would nearly offset the cost of installation of one extra auger in the floor in the new planned warehouse and the cost of one new elevator leg and the receiving pit. The cost of moving the rice facilities could be accomplished with existing labor at the facility.

PRIORITY 3. Add space for bulk storage (bottom photo, p. 43).

At present, there is a small portable bin and related bagging facilities in a building that is of the same construction as the adjacent bulk warehouse. The area used for bagging has an overhead auger and an auger under the floor that is used to fill and empty the existing warehouse.

There is an existing spout from the top of the elevator leg to the warehouse across a driveway. I recommend that the bagging facilities with the holding tanks be transferred to the warehouse, and the maize bagging operation established there. This would relieve valuable space for bulk storage and allow lift trucks to pile bags of grain as they were bagged.

The building housing the present bagging operation is of the same structural strength and has the identical floor as the bulk storage facilities. The only cost involved would be the cost of moving the existing bagging facilities, which could be accomplished with existing labor at the facility. There is a well-equipped workshop at the IRA grain complex at Usulutan; therefore, minor alterations can be made. The only large cost would be for iron sheeting and lateral cross beams to strengthen the sidewalls for bulk grain. The construction would be the same as the bulk warehouse; therefore, design would not be necessary, and I am confident that the capable personnel at Usulutan

could accomplish the work if the materials were purchased. If this space were used for bulk storage, the entire building would be used for the same purpose, thus consolidating the bulk storage. It would be advisable to install aeration equipment when installing the walls.

PRIORITY 4. Evaluate bagged grain storage needs after bulk storage facilities completed.

If more emphasis is placed on bulk storage, the needs for a warehouse to store bagged commodities should be less critical. At present there is a large warehouse for storing bagged grain. This is the building in which the maize bagging facilities should be located.

IRA is renting warehouses that were formerly used for cotton. I do not know if the rent is excessive, but most of the warehouses are in good condition. They could be altered with little expense, however, to allow a lift truck to enter the building to facilitate piling and removing bags from the warehouse. Bags of maize were piled directly on the floor. With the high humidity and heat at Usulutan, it is very likely that the first tier of bags may contain some moldy grain. There should be an air space under bags so there can be no direct contact with the floor.

I recommend delaying construction of facilities for bagged grain until more space is made available for bulk storage. If this is done, the construction of a warehouse for bagged grains may not be necessary.

PRIORITY 5. When needed, add dryer to railroad side of elevator (bottom, page 41).

At present, the drying facilities are adequate. The dryer is a continuous flow type which dries at the rate of 450 quintals per hour, with a moisture reduction of maize of 5 percent. Maize is being dried to 12 percent, which is essential at Usulutan because of the high humidity. If there is a need for an additional dryer, one can be easily installed on the side of the elevator adjacent to the railroad track. The location of the dryer is shown in the bottom photo,p.41). The dryer could be filled with the existing elevators and discharged into a nearby elevator leg. Very few alterations would be required. When a new dryer is purchased, the possibility of using propane gas should be reviewed and a comparison made between the cost of diesel fuel and propane gas with consideration given to the possible fumes absorbed by the grains being dried.

PRIORITY 6. Accept gross weight when weighing large trucks.

The present truck scale has sufficient length and capacity to weigh a front and rear axle truck (2.70 m. x 6.24 m.). It is not long enough to weigh a semi-trailer. If gross weight would be accepted, though, it is possible to weigh longer trucks by weighing each axle or axle groupings separately and then adding the weights to obtain the gross tare or gross weight of a load. If this technique is used, the ground on each end of the scale should be the same level as the scale to prevent any leverage. Also each time an axle grouping is weighed, the operator of a truck should be required to leave the cab so that it will not be possible to apply the brakes to one axle while applying the power to another axle, which could affect the leverage of the scale.

There is no error in this method of weighing but the weights could be different due to the amount of the calibration of a scale each time a weight is taken. If the scale were calibrated in 10 pounds increments, then it would be possible to have a gross difference of 30 pounds, or not less than 10. If two weights were taken, it is possible that the "breakage" would cancel by a plus and minus and the same weight would be obtained as if the truck were weighed in one operation. The greatest possible difference from weighing a large truck in three operations would be 60 pounds, 30 accumulated in tare and 30 pounds in gross. However, the possibility of this happening can only be speculative.

If this method of weighing were accepted, the purchase of a larger scale could be delayed until a decision is made regarding the size and use of the proposed grain facility at San Miguel.

In my discussions with farmers in the markets, along the roadsides, or at their farms, with the assistance of an interpreter, there seems to be no established marketing pattern. The farmer sells his commodity if he needs the money and, if possible, holds his grain for a higher price if not satisfied with current prices. Of course, all farmers plan to keep sufficient grains for family needs.

I was surprised to learn that the farmers were very aware of the current prices that were being paid for commodities. As an example, the current price at the farm in the Metapan-Santa Ana area was 9½colones per quintal (100 pounds) and 10 colones per qq. at the market in the city. If the retailer purchased at 10 colones, he was willing to sell at 11 colones. I was not able to determine how much maize was being held for a possible higher price but no doubt there was maize being placed in storage. The local retailer was interested in a quick turnover. Although he purchased maize that was sufficiently dry for temporary storage, the retailer would find a place to further dry a commodity in the sun if necessary.

The price of maize, possibly because of dry weather, was about 1 colon higher in the area of Ciudad Barrios. There were large acreages of white grain sorghum that will be harvested in January and will substitute for maize; therefore, maize imported to Ciudad Barrios from the Usulutan area was only temporary.

It is my conclusion that the greatest amount of grain is now being sold at the roadside. The extreme distance that a farmer apparently travels by ox cart or pack animal is 10 to 15 kilometers. Since it is impossible to travel into the hills with a vehicle, maize will continue to be brought to the roadside. Therefore, it is impossible for IRA to establish buying stations that will be accessible to all farmers. It will be to the farmer's advantage if more buying stations can be established, and there would be more probability of the price being stable if there is support price.

In many instances, it is to the farmer's advantage to hold his commodity for a higher price if he is in the financial position to do so. Certainly it is to his advantage to keep his commodity in good condition for ultimate sale or for his own use.

PRIORITY 1. Conduct research on present home storage facilities.

In many of the farm homes, and in some of the retail stores, a small lightweight metal tank is used to store grain. The tanks have an opening in the top for filling and an opening at the bottom for removing the grain. The capacity of the bins is from one-fourth to 1 ton. It is an ideal way to protect grain from rodents and insects when the openings are closed with metal covers. It is desirable for the farmer to have his own inexpensive "on-the-farm" storage in several small tanks or bins, either for his future food supply or to store grains that will be sold. In any event, it is wise for the farmer to maintain quality.

I regret that I did not have time to conduct experiments of aerating grain in a small tank by forcing air into the bottom opening or removing air from the opening. If an aeration fan were operated during periods of low humidity, possibly in the afternoons when the sun is shining, it could have some drying effect and perhaps remove several points of moisture from the grain. There are many types of electric combination blower/suction fans that could be attached to the opening at the bottom of the small bins. It is also possible that some company makes a hand-operated fan.

Experiments could be conducted placing a commodity of known moisture content into a tank and then operate the fan during periods of presumed low humidity. If it were possible to remove moisture or to maintain quality, IRA could advise the farmers of the technique. The experiment would be time consuming to be positive of the results, but it would not be costly. IRA has an interest in helping farmers. and could also be the ultimate buyer of a commodity. Therefore, experiments to improve quality would be justified. The experiment would require several small tanks and an electric blower/suction fan. All the equipment could be sold after the experiment was finished.

PRIORITY 2. Establish buying stations.

In the preface of this report, I alluded to the intent of IRA to place a commodity into the marketing system in times of scarcity. The present facilities at San Martin and Usulutan are a great distance from some production areas.

I am cautious in my recommendations for I do not wish to recommend excess capacity that may not be used or is impractical for a location. Total production of the country can be altered by weather, and economic conditions could be such that the private sector would make purchases above a support price. It is very difficult to accurately determine the tonnage of a commodity that will be sold to IRA when buying stations are established. It will take several years to establish a market pattern. Several of the farmers I visited stated they sold to IRA because they liked the "weights." If IRA continues to have the confidence of the farmer and the consumer, the goals of IRA will be accomplished.

I did not have time to determine the exact locations for buying stations, for it would be necessary to have more information regarding roads, market information, and availability of land. I can only state that a buying facility should be located near a road, a three-phase power line, and in areas of production.

IRA is considering the construction of facilities at San Miguel, Santa Ana, and Sonsonate, each with a capacity of 13,000 M.T. A report of El Salvador (Sept. 1972) RED DE GRANOS BASICOS EN ZONAS DE PRODUCCION recommends buying station capacity of 25,000 M.T. in addition to the 39,000 M.T., or a total of 64,000 M.T. This projection alters the May, 1972, Lemley report of 52,500 M.T. Both reports make reference to the same areas but, in several instances, different locations for buying stations.

Since there can be no accurate prediction of how buying stations will be accepted by the farmers, I recommend that a facility be established with a limited amount of capital investment and expanded as required. I will not recommend a type of facility that has horizontal augers to fill silos. Conveyor augers are not self-cleaning and, where different grains are to be handled, mixing of grains would result. A belt-type conveyor is self-cleaning but it is very expensive, requires a great deal of maintenance, and cannot be easily altered for expansion.

Making reference to the layout of buying stations, the ground plan could be the ultimate and could have a capacity of 4,248 M.T. if 31 foot bins were used (outside perimeter). All bins could be filled by gravity. The system would use a continuous flow dryer and have a warehouse attached for bagged grain if necessary. The entire complex, ready to accept grain, would cost approximately U.S. $350,000 without the warehouse.

Rather than building a large buying station without knowing how much and what commodities are to be purchased, I recommend that IRA make a contract with a company to purchase grain bins and related equipment from the company for a period of at least 5 years. My reason is that, as facilities are expanded, they should be of the same make and design so the facilities are compatible. It may be possible to work out a contract that will guarantee performance, delivery, and payment by requiring both parties to place money in escrow until the contract period ends.

I recommend that the semi-circle arrangement be used, with the grain bins 27-foot in diameter with 14-foot sidewalls each having a capacity of 150 M.T. The bin would be complete with a drying floor, ladders, center draw auger for unloading, a tube into which a portable auger could be placed for bagging, walk-in door if needed for bagged storage, and a bagging tube in the door panels. The bin would be equipped with the appropriate size drying fan and a 17,700 BTU heater. No leveling equipment is included; grain should be kept level in the bins by using manual labor.

At least 150 square meters should be available so an entire semi-circle of bins could be erected if needed. If the volume of grain requires mechanical loading of the bins, I recommend purchasing a portable rubber-tired auger (6-inch tube, 60 feet in length) equipped with an electric motor and with a hopper at the bottom and a hood at the top to prevent rain entering the bin in cases of sudden showers. This type of auger, shown in the layout of buying stations, is easily cleaned and can be quickly changed from one bin to another. I would not recommend the use of a concrete cone-shaped pit for the bottom of the auger. These pits collect rain, are an extra expense, and decrease flexibility. The hopper attached to the auger serves the same purpose.

I also recommend the purchase of a 14-foot, 6-inch auger compete with motor but without a lifting mechanism. This could be placed by hand into the 45 degree angle tube in the grain bin and then used for bagging or filling a truck with bulk grain. In this manner, grain could be bagged or removed while filling another bin with the large wheel-type auger.

I stress that all the equipment should be from the same manufacturer so that machines or parts could be interchanged to different locations as needed. Because of the low investment and simplicity of this type of system, IRA may wish to provide more stations at other locations.

Unless an extremely large facility were to be developed, I would not advise the installation of vertical elevators. Nicaragua has two basic types of grain handling systems, one a verticle elevator filling a semi-circle of bins and another using the semi-circle of bins filled by a portable auger. One official stated, during an evaluation there, that the portable auger was more satisfactory because of its simplicity, fewer mechanical problems, and lower initial cost.

Moisture meters and temperature monitoring equipment should be used at the sites. It may also be desirable to hard-surface the area around and within the semi-circle of bins to prevent the loss of grain and to assist in sanitation.

A buying station of minimum capacity should have sufficient production within the area to support an operational facility, including the capability of cleaning and drying equipment. In areas where it is more certain that the facilities would be used, bins could be erected in the beginning of the semi-circle, the site equipped with a wheel-type auger, small portable auger, moisture tester, platform scale, and, if required, a roof erected by local or IRA labor. IRA shops could easily make a small hopper for bagging as needed.

The James W. Lemley report on May 6, 1972, indicated the need for buying stations at the following locations, with the suggested capacity:

Santa Ana	4,500 M.T.	Sensuntepeque	3,500 M.T.
Ahuachapan	3,500	Ciudad Barrios	3,500
Sonsonate	8,500	Mercedes Umana	3,500
Metapan	3,500	San Miguel	6,500
Aguilares	7,500	Santiago Nonualco	4,500
Nueva Concepcion	3,500	Total	52,500 M.T.

A second report for El Salvador, RED DE SILOS PARA GRANOS BASICOS EN ZONAS DE PRODUCCION, dated September 1972, indicates seven zones as follows:

Metapan	3,500 M.T.	Santiago Nonualco	4,500 M.T.
Cara Sucia	2,500	Jiquilisco	4,500
Nueva Concepcion	4,500	Chapeltique	2,000
San Juan Opico	4,500	Total	26,000 M.T.

These recommendations of the ZONAS DE PRODUCCION report would be supplemented by large facilities constructed as follows:

1973-74	San Miguel	13,000 M.T.
1975-76	Santa Ana	13,000
1975-76	Sonsonate	13,000
	Total	39,000 M.T.

It is difficult to make a recommendation on location and size of facilities until the large facilities have been committed. I would immeidately cancel the station at Jiquilisco since this is only 15 kilometers from Usulutan. There is proposed bulk storage for Usulutan and the bulk capacity could be expanded beyond the proposed bulk warehouse.

For an approximate cost analysis I am suggesting the proposed buying stations equipped with drying bins which could be immediately expanded or, if not used, dismantled and moved to another area.

RADIO SYSTEM

The estimated costs for establishing an operational radio communication system linking the IRA facilities and trucks would be approximately $1,000 per radio. In addition, $1,200 would be needed for a repeater for the private IRA channel described in the radio discussion included in the "General Recommendation" section of this report.

The total for immediate needs, then, would be $3,000 for the three base stations; $1,000 for each mobil unit, as determined by IRA needs; and $1,200 for the repeater. The radio equipment should be at least 30 watt output and fully transistorized.

A logical expanded operation might include five base stations ($5,000); five mobil units ($5,000); and the repeater ($1,200). This could be accomplished between 1974 and 1976.

SAN MARTIN

Estimated alteration and other contruction costs for the San Martin facility are included in Table 1 together with a suggested time schedule for doing the work.

Table 1. Construction recommended for San Martin, with suggested schedule and estimated cost.

Work Needed	Year Work to be Completed	Estimated Cost
		U.S. $
Roof	1973	$30,000
Installation of floor receiving pit for bulk grain	1973	2,000
Extension of ramp	1973	500
Enclosure for bagging area	1973	200
Dehumidifer		1,000
Closing road and removing existing fence (No cost)	1973	
Hard-surface road between areas	1973	200
Roof for new grain bins	1974	9,200
Cleaner, spouting, conveyor alteration and installation	1974	6,000
Land fill	1974	1,500
		$50,600

USULUTAN

Estimated costs of alterations and construction at the Usulutan facility, together with a suggested time schedule, are shown in Table 2. Cancelling two elevators, two conveyors, two roofs, and two concrete docks included in planned warehouse reduced the cost of that plan $7,000.

Table 2. Construction recommended for Usulutan with time schedule and estimated cost

Work Needed	Year Work to be Completed	Estimated Cost
		U.S. $
One additional floor auger in new warehouse	1973	$3,000
Conveyor for new warehouse (Inside-top)	1973	3,000
New elevator and pit to discharge into two round bins	1974	3,000
Moving present bagging equipment	1974	500
Iron siding and steel cross beams to enlarge present warehouse	1974	3,000
Installation of new dryer (450 qq. per hour)	1974-75	15,000
	Total	$27,500

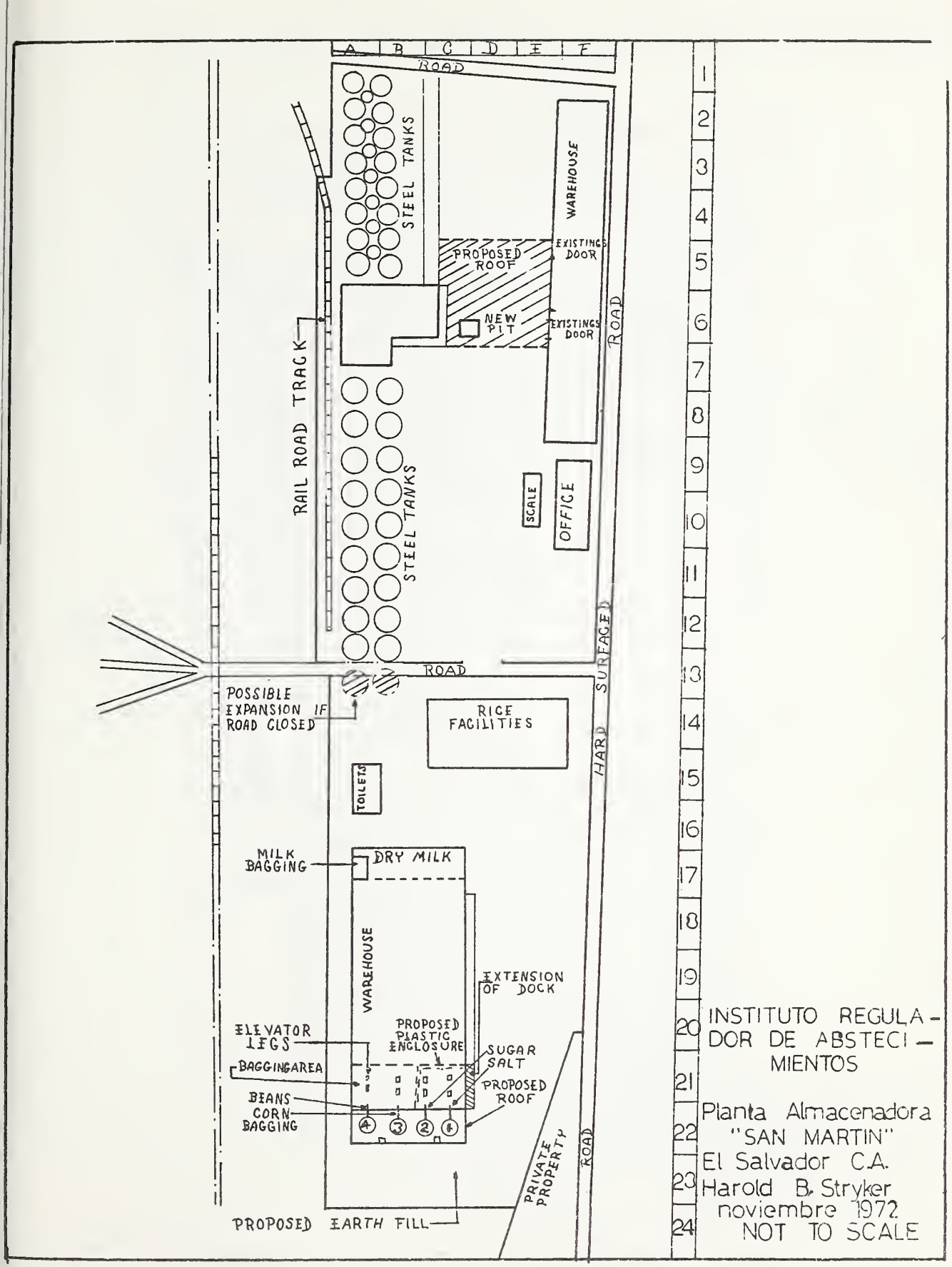
BUYING STATIONS

Construction and alteration costs for buying stations are summarized in Table 3.

Table 3 . Estimated construction cost for buying stations

Item		Location	Capacity	Estimated Cost
			Metric Tons	U.S. $
One drying bin; one platform scale; and a manager on a part time commission basis		Ciudad Barrios	150	$ 6,000
		Sensuntepeque	150	6,000
		Chapeltique	150	6,000
	Subtotal		450	$18,000
Three bins	($16,500)	Metapan	450	18,880
One-wheel auger	($ 1,200)	Nueva Concepcion	450	18,880
One small auger	($ 300)	Cara Sucia	450	18,880
One platform scale	($ 500)	San Juan Opico	450	18,880
One roof	($ 300)	San Juan Nonualco	450	18,880
One moisture tester	($ 80)	Mercedes Umana	450	18,880
	Subtotal		2700	$113,280
	Total		3150	131,280

Appendix A. Plans relating to San Martin, Usulutan, and proposed buying station facilities.


A
B
C
D
E
F
ROAD
STEEL TANKS
WAREHOUSE
PROPOSED ROOF
EXISTINGS DOOR
NEW PIT
EXISTINGS DOOR
ROAD
RAIL ROAD TRACK
STEEL TANKS
SCALE
OFFICE
ROAD
HARD SURFACED
POSSIBLE EXPANSION IF ROAD CLOSED
RICE FACILITIES
TOILETS
MILK BAGGING
DRY MILK
WAREHOUSE
EXTENSION OF DOCK
ELEVATOR LEGS
PROPOSED PLASTIC ENCLOSURE
SUGAR SALT
BAGGINGAREA
PROPOSED ROOF
BEANS
CORN
BAGGING
4
3
2
1
PRIVATE PROPERTY
ROAD
PROPOSED EARTH FILL
1
2
3
4
5
6
7
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11
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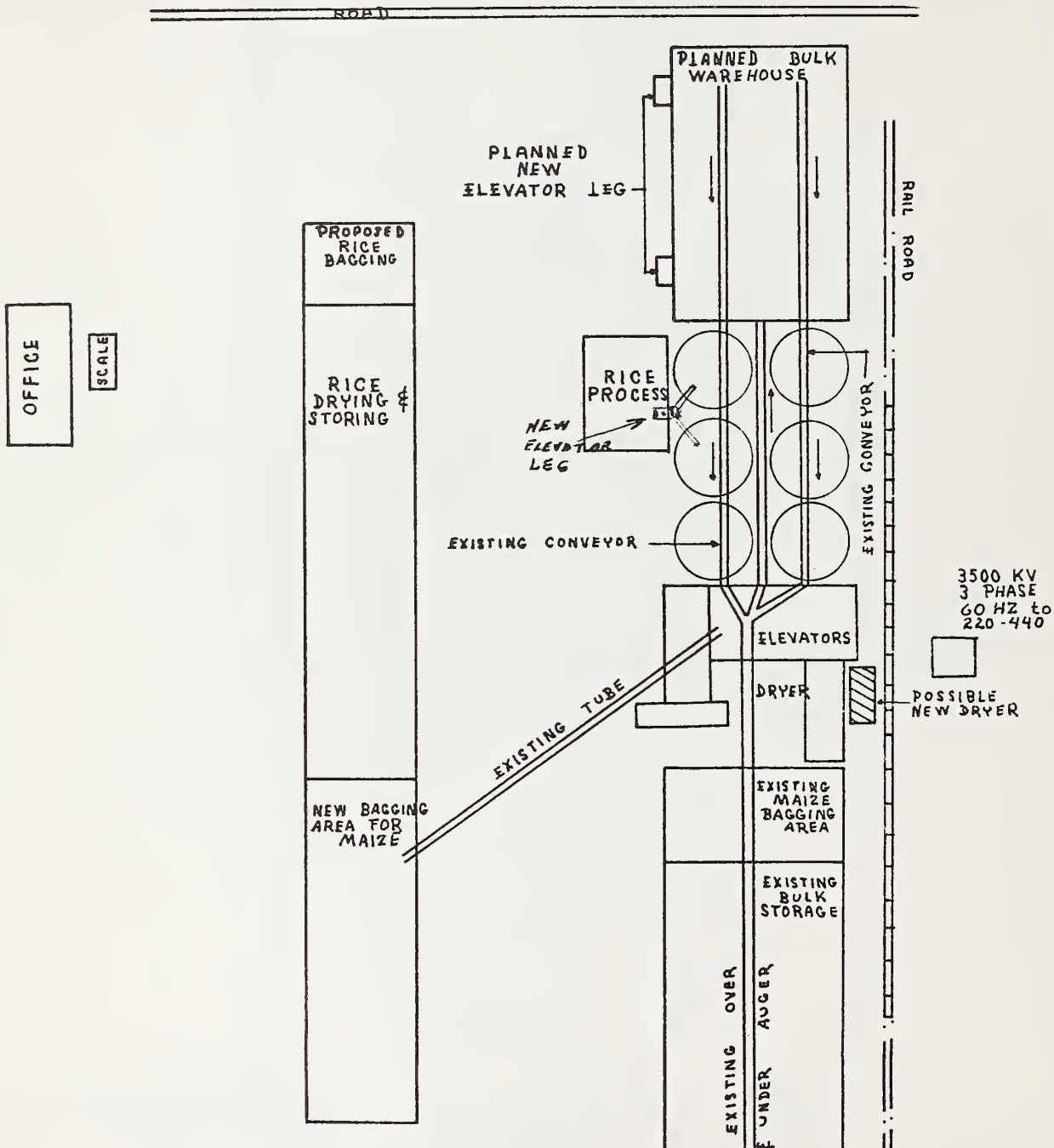
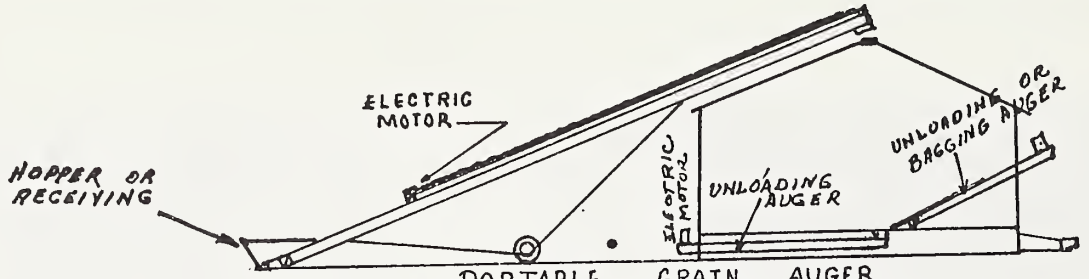
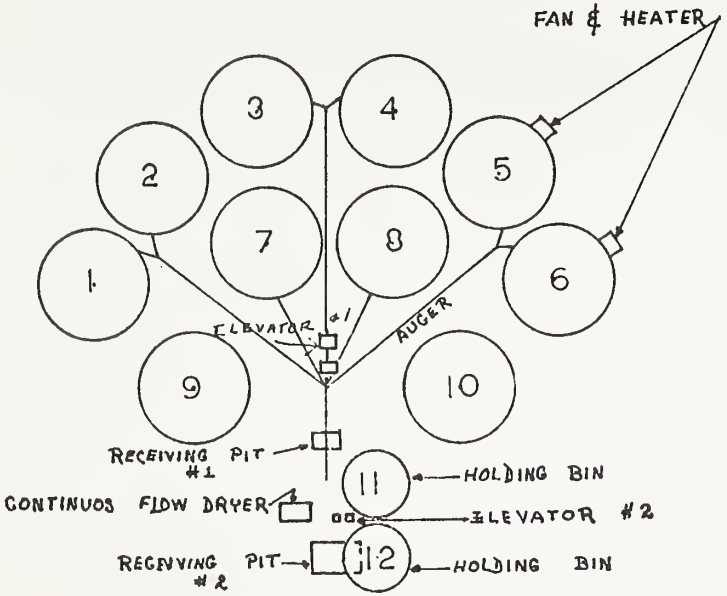
24
INSTITUTO REGULADOR DE ABSTECIMIENTOS
Planta Almacenadora "SAN MARTIN"
El Salvador C.A.
Harold B. Stryker
noviembre 1972
NOT TO SCALE

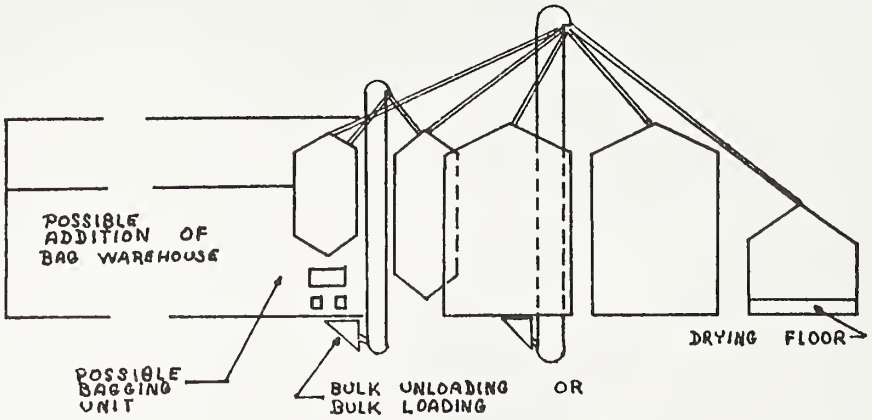


INSTITUTO REGULADOR
DE ABASTECIMIENTOS
Planta "USULUTAN"
Harold B. Stryker
NOT TO SCALE



PORTABLE GRAIN AUGER
6" to 8" DIA. OF TUBE
10' to 70' LENGTH AS REQUIRED BY BIN HEIGHT
ELECTRIC MOTOR H.P. DETERMINED BY DIA & LENGTH



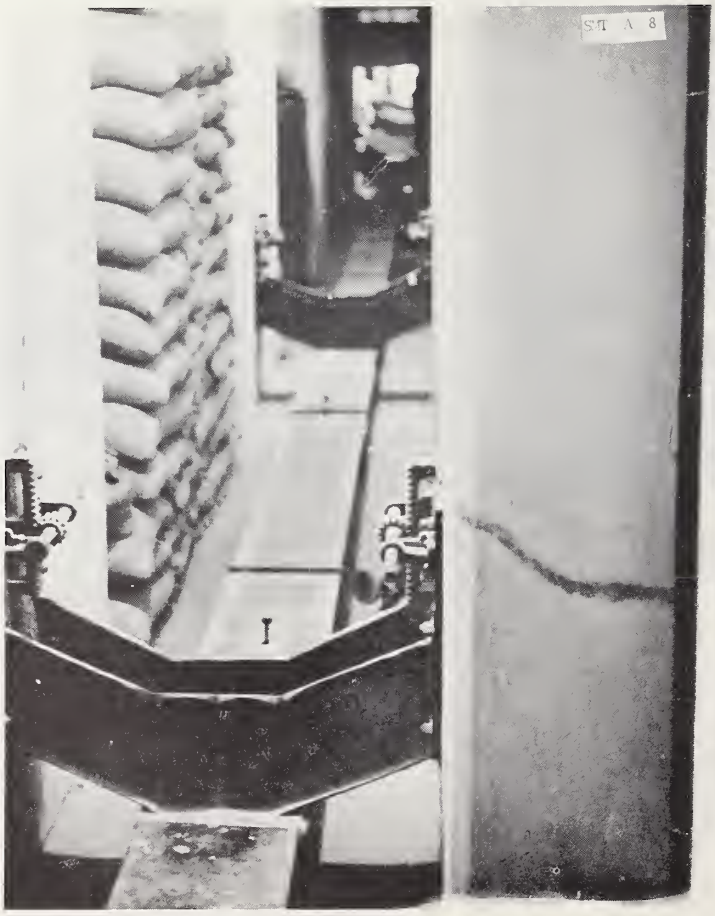


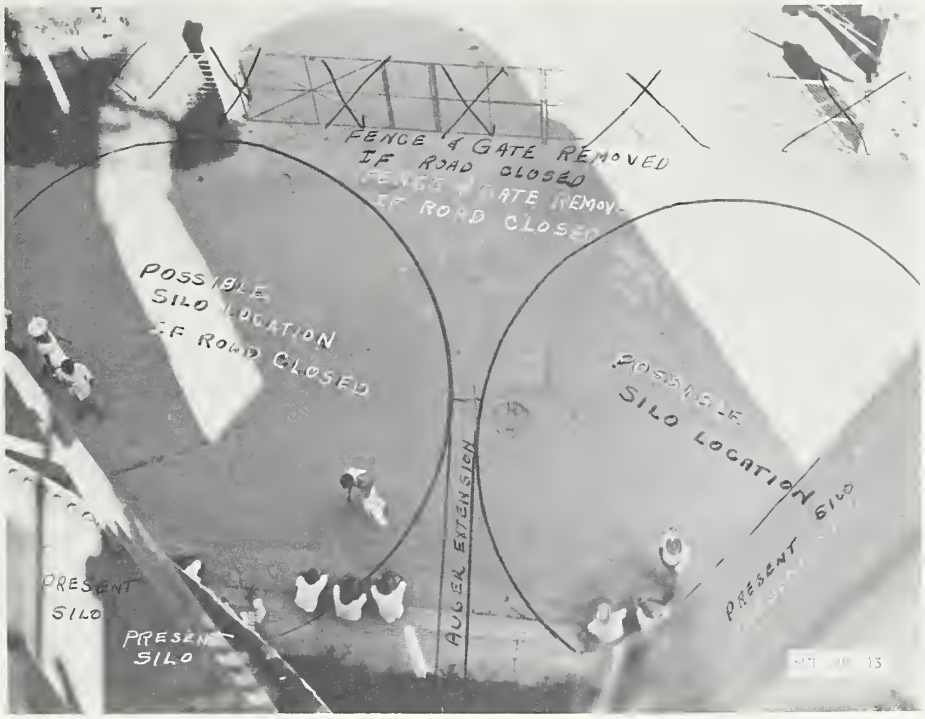
PROPOSED EXPANDABLE BUYING LOCATIONS
Harold B. Stryker
NOT TO SCALE

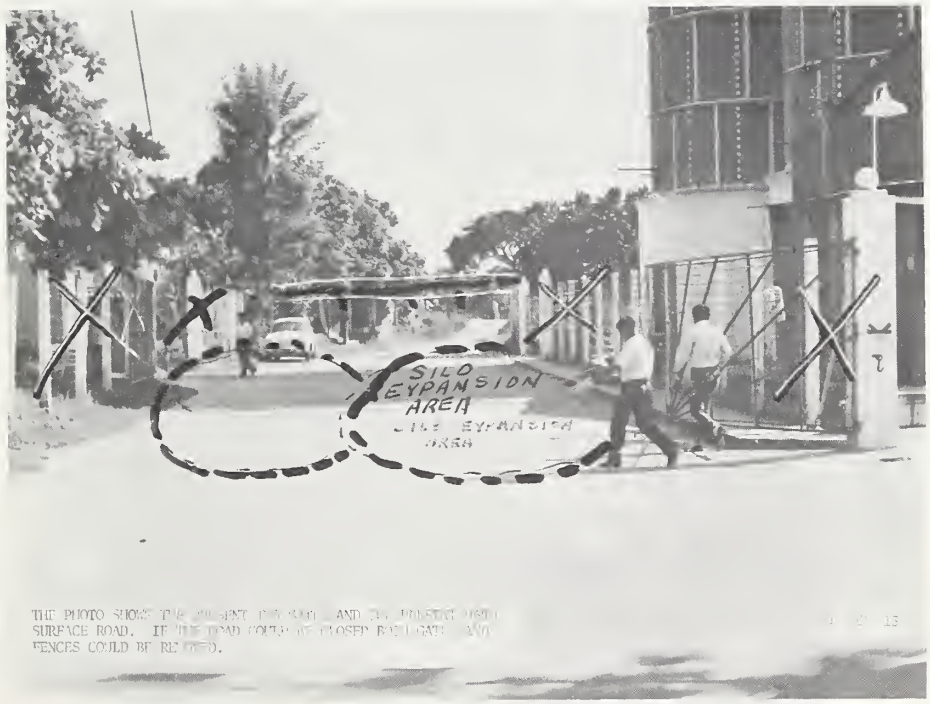
Appendix B. Photos relating to San Martin, Usulutan, and proposed buying station facilities.

ROAD THAT COULD POSSIBLY REPLACE THE PUBLIC ROAD THAT SEPARATES THE IRA GRAIN HANDLING FACILITIES.

A PROPOSED AUGER COULD CONNECT THE RECEIVING PIT TO AN EXISTING AUGER THAT IS CONNECTED TO THE ELEVATOR LEGS


SIT A 8





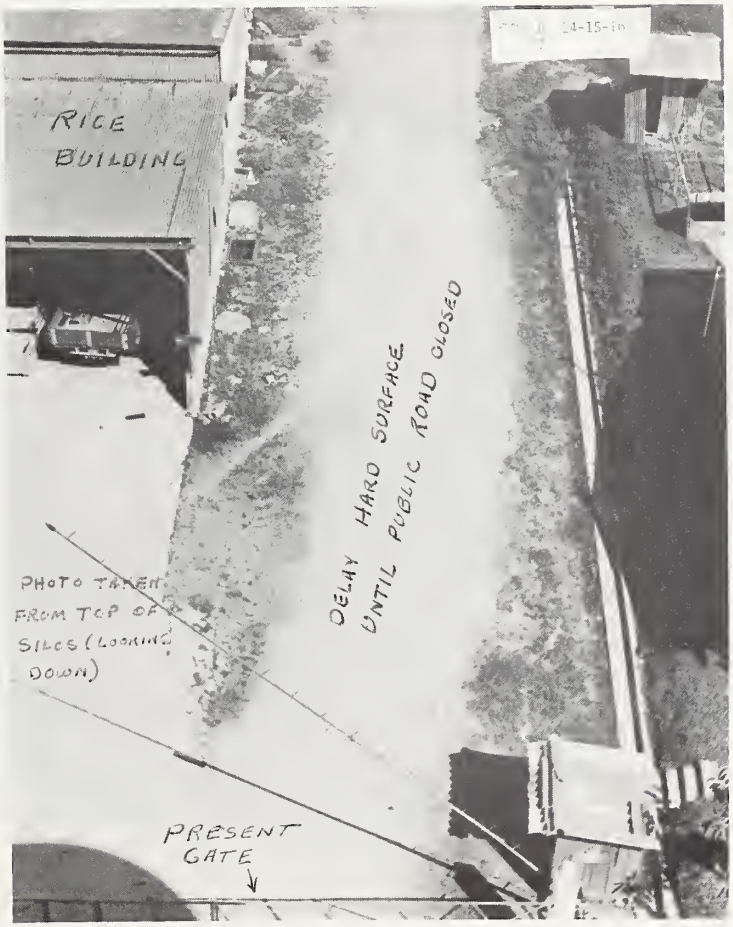
THE PHOTO SHOWS THE PRESENT [illegible] AND THE PROPOSED [illegible] SURFACE ROAD. IF THE ROAD COULD BE CLOSED BOTH GATE AND FENCES COULD BE REMOVED.

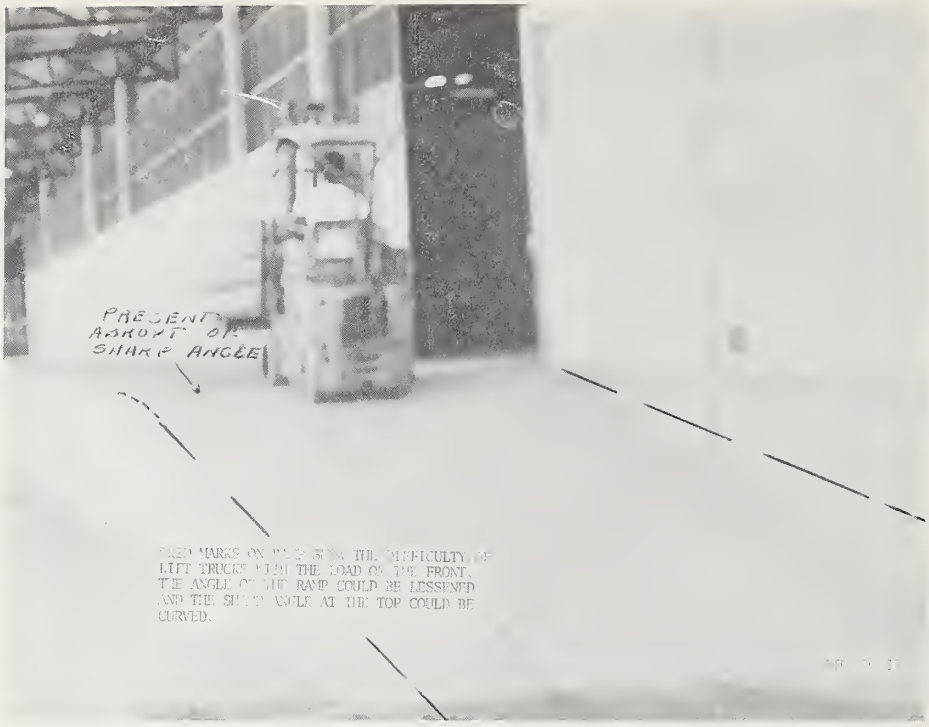
THIS SHOWS THE PUBLIC ROAD AS IT LEAVES THE COMPLEX. IT MAY BE POSSIBLE TO MAKE A NEW ROAD ADJACENT TO THE RAILROAD TRACKS THAT WOULD CONNECT TO THE ROAD WHICH IS AT THE END AND OUTSIDE OF THE IRA FACILITIES.

SIT A 13

SIT E 13


RICE BUILDING
PROPOSED HARD SURFACE
T E 14-15-16
#1

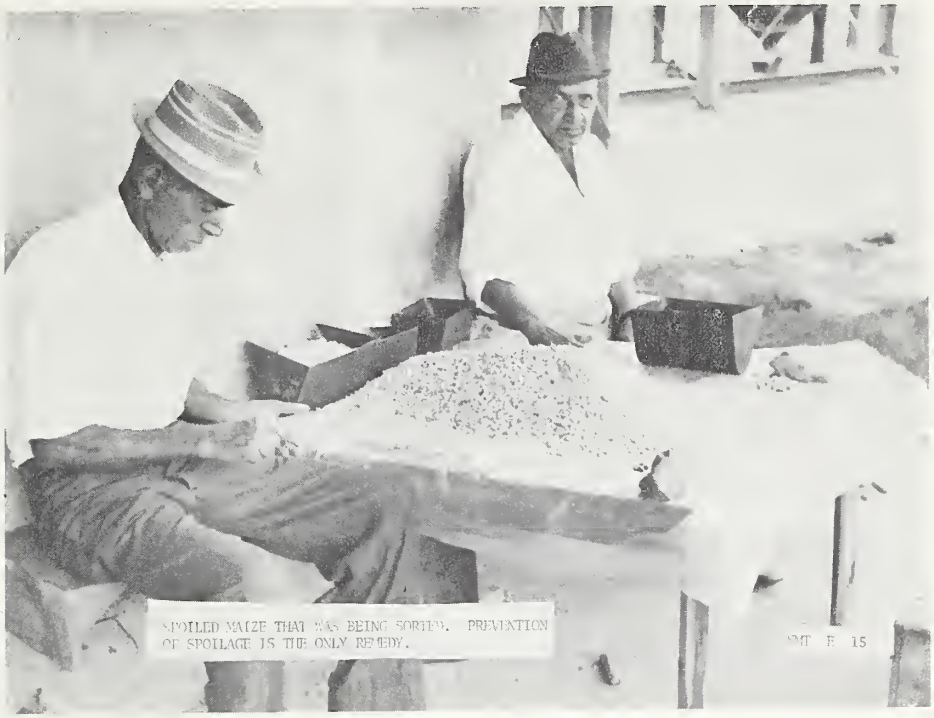

RICE BUILDING
DELAY HARD SURFACE UNTIL PUBLIC ROAD CLOSED
PHOTO TAKEN FROM TOP OF SILOS (LOOKING DOWN)
PRESENT GATE



FIXED MARKS ON [illegible] THE DIFFICULTY OF LIFT TRUCKS WITH THE LOAD ON THE FRONT. THE ANGLE OF THE RAMP COULD BE LESSENED AND THE SHARP ANGLE AT THE TOP COULD BE CURVED.

RICE FACILITIES THAT COULD BE USED TO PRE CLEAN AND STORE BULK BEANS WHEN NOT USED FOR RICE.

SPT F 35

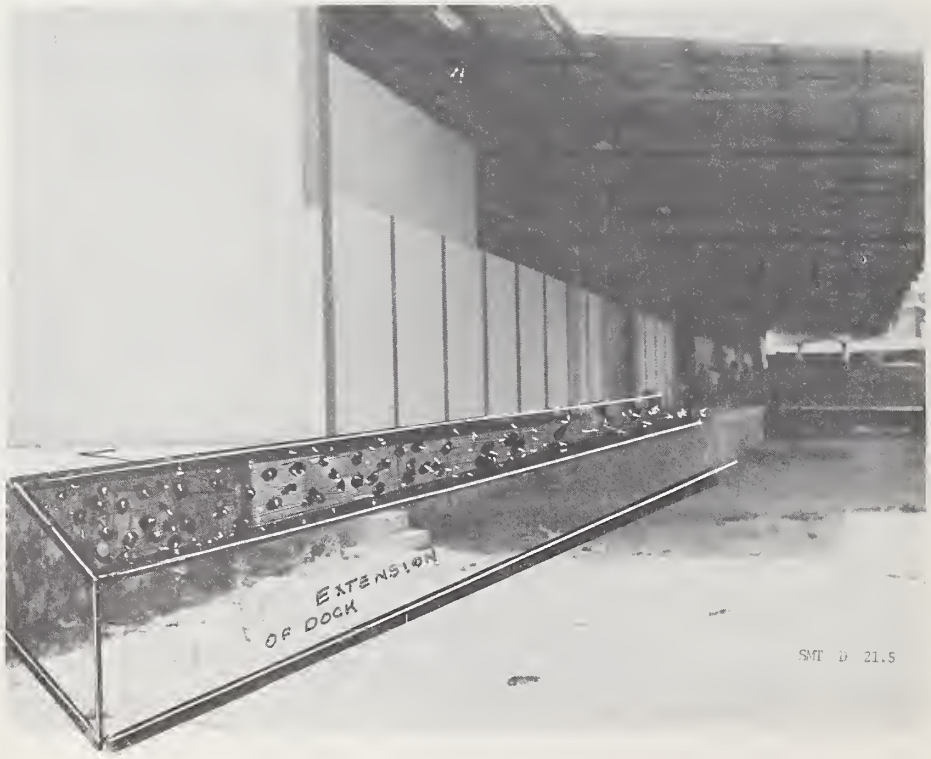


SPOILED MAIZE THAT WAS BEING SORTED. PREVENTION OF SPOILAGE IS THE ONLY REMEDY.

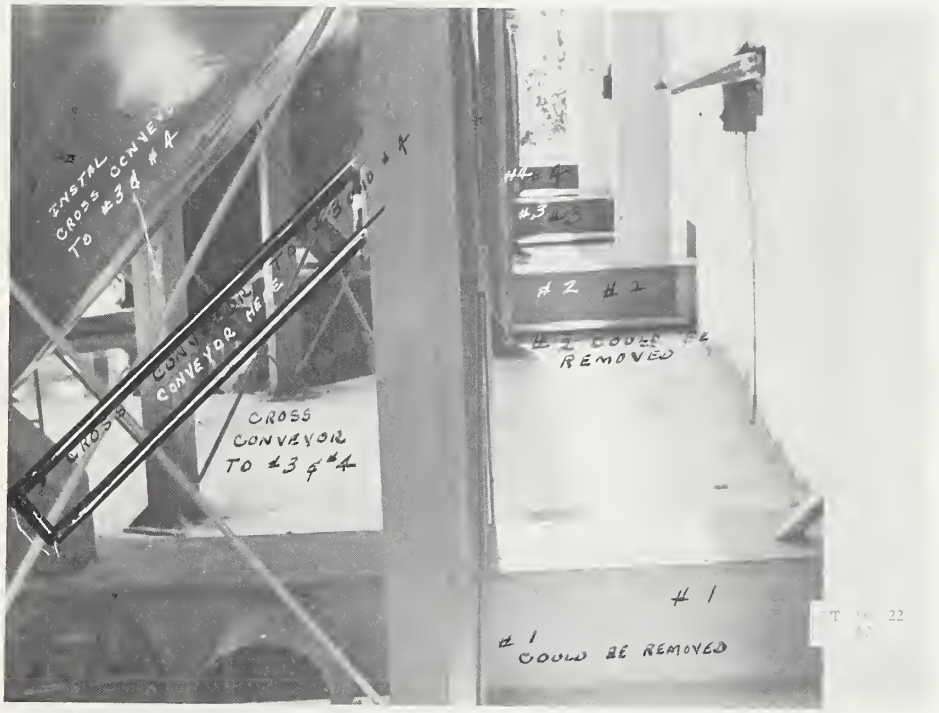
SMT F 15

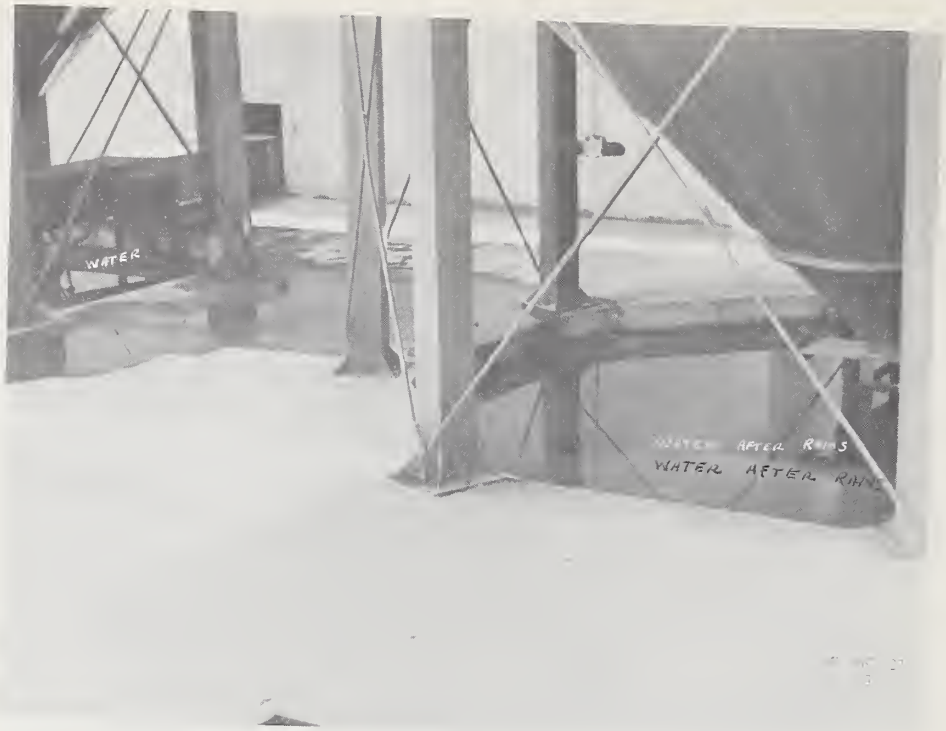
CLEANING BEANS BY HAND.

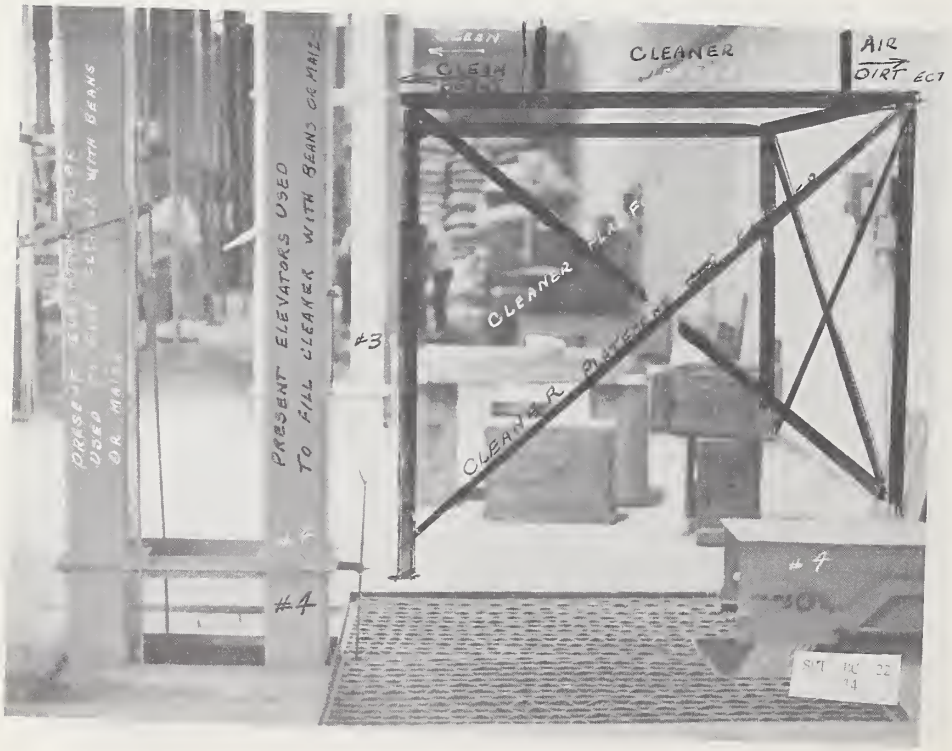

EACH PALLET SHOULD BE UNIFORMLY FILLED WITH
THE SAME NUMBER OF BAGS METHOD OF PILING
THE BAGS ON THE PALLET SHOULD BE UNIFORM SO
THAT BAGS CAN BE NEATLY STACKED AND COUNTED IF
NECESSARY.

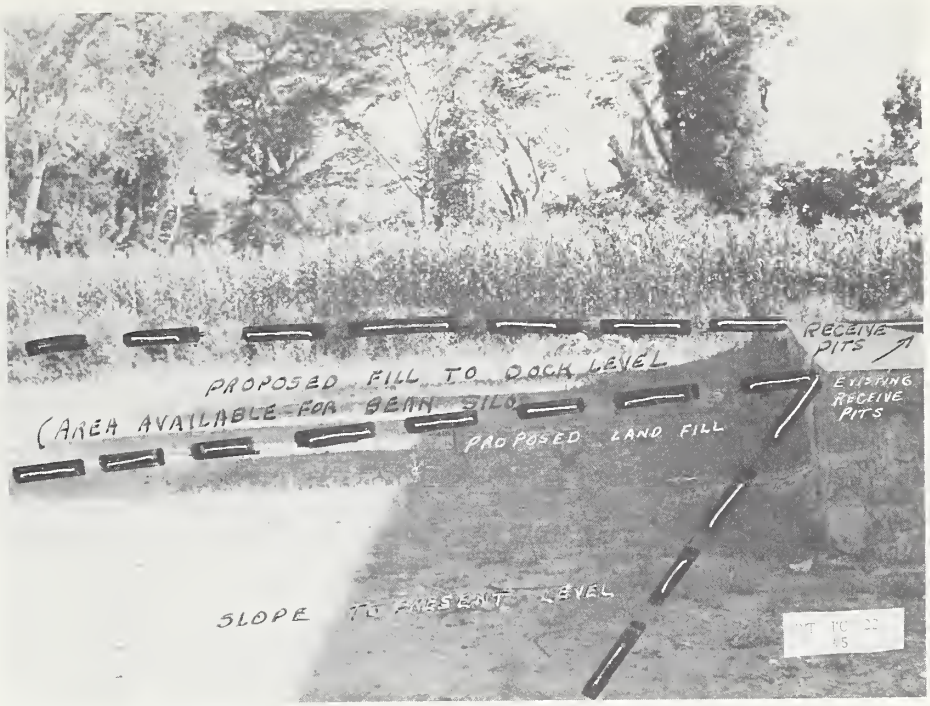

EXTENSION
OF DOCK

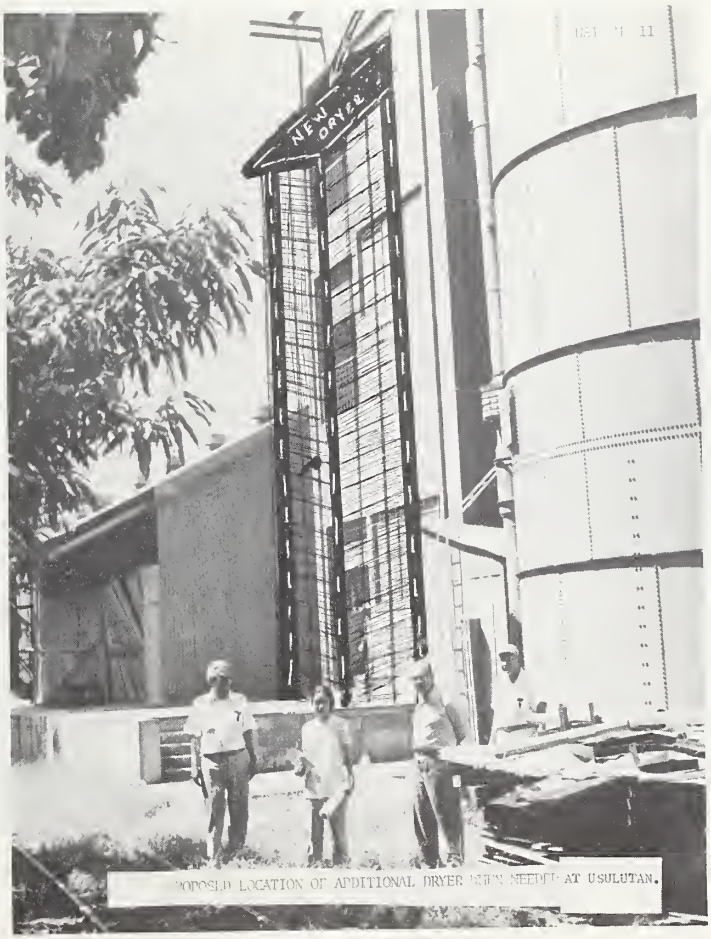

OUTLET FOR CLEANOR
OUTLET FOR AIR FROM CLEANER
PROPOSED ROOF
#4
#3
#2
#1
CROSS CONVEYOR


EASTAL CROSS CONVEYOR TO #3 & #4
CROSS CONVAYOR TO #3 & #4
#4
#3
#2
#1
#1 COULD BE REMOVED
#1 COULD BE REMOVED

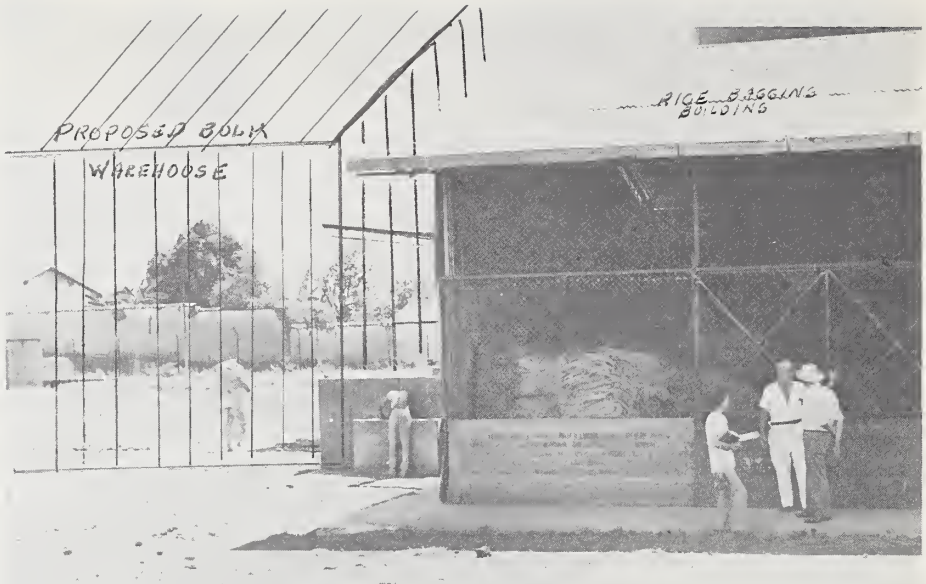

WATER
WATER AFTER RAINS
WATER AFTER RAINS


PRESENT ELEVATORS USED
TO FILL CLEANER WITH BEANS OR MAIZE
CLEANER
AIR
DIRT
#3
#4





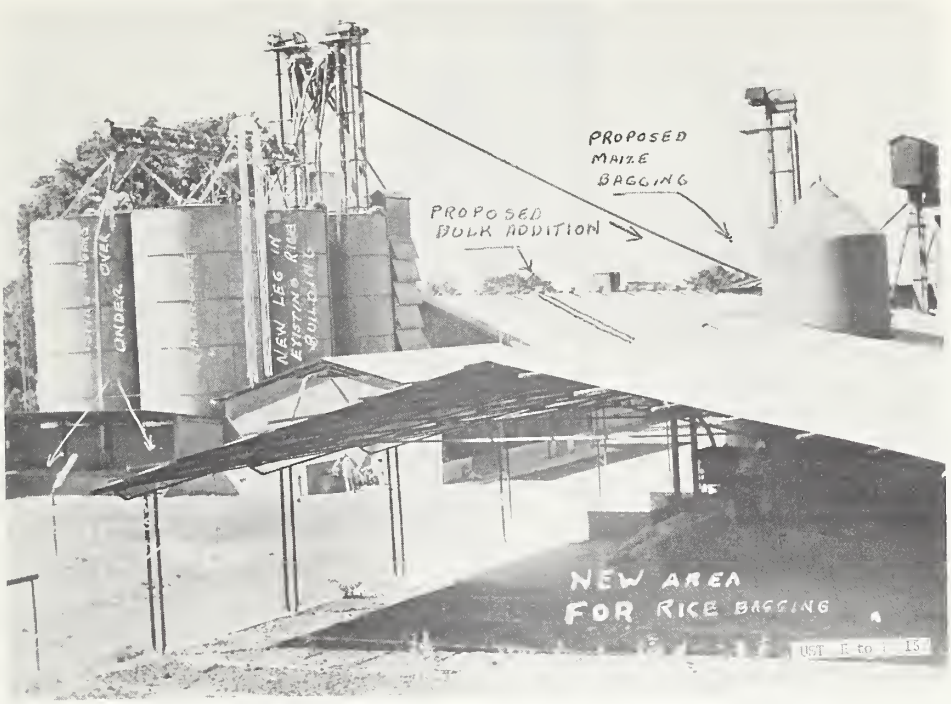
PROPOSED LOCATION OF ADDITIONAL DRYER WHEN NEEDED AT USULUTAN.



USI PROPOSED AND PLANNED WAREHOUSE FOR STORING BULK GRAIN. USI E 6

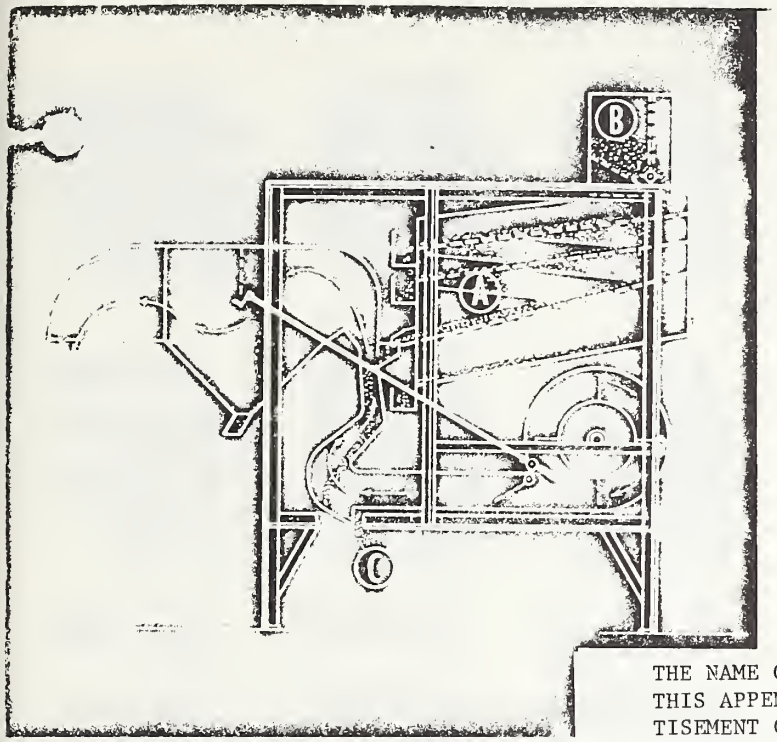
USI THE PORTION OF THE PIPE IN THE UPPER LEFT IS FROM THE TOP OF THE ELEVATOR LEG TO THE BUILDING THAT COULD BE USED FOR BAGGING MAIZE TO ALLOW THE PRESENT SITE TO BE USED FOR BULK STORAGE. THE OPENING ON THE MIDDLE RIGHT IS A PART OF THE PRESENT BAGGING OPERATION.

AN ELEVATOR LEG COULD BE PLACED IN THE PRESENT RICE FACILITIES TO ALLOW FOR DISCHARGE INTO TWO ADJACENT BINS. THE PIT COULD BE IN THE BUILDING NOW USED FOR BAGGING RICE. USI E to I 15



PROPOSED BUILDING FOR ADDITIONAL BULK STORAGE. THERE IS A OVERHEAD AND A UNLOADING AUGER IN THE BUILDING THAT IS USED TO FILL AND UNLOAD THE BULK STORAGE THAT IS TO THE RIGHT IN THE SAME BUILDING.

Appendix C. Grain Cleaning Equipment.



Shown is a Flow Diagram of a 3-screen model. Construction and operation of the two and three screen models are similar. Return pans (A) between the screens gives tandem flow to consecutive screens and provides more useful screening area. Commodity is shown entering cleaner hopper (B) with clean seed (C) discharging below.

THE NAME OF THE MANUFACTURE HAS BEEN DELETED SO THIS APPENDIX CANNOT BE CLASSIFIED AS AN ADVERTISEMENT OR AS AN ENDORSEMENT. THE PAGE IS TO SHOW THE PRINCIPLE OF USING A CLEANER FOR BEANS OR AN AIR SEPARATION PROCESS FOR A VARIETY OF GRAINS.

HOPPERS — Type A — Used to feed the smallest kinds of seed as well as grain, beans, corn, etc., containing pods, cob particles, sticks, straw or other foreign material. These hoppers will not become plugged or flood the screens when passing coarse material, and will feed the commodity to the screens in a constant, even flow. A clutch is provided on the feed roll for instant shut-off. TYPE B — provided with spiked feed roll for feeding undelinted cotton seed and other trashy kinds of seed. This hopper can be supplied as an interchangeable or auxiliary unit. TYPE C — Special hopper for feeding the light weight grass seeds such as Ryegrass, Bent, Fescue and Brome. It is especially valuable for feeding grass seeds containing Rattail Fescue, etc.

SCREENS — Cleaner Screens *are easily visible and interchangeable from the front of the machine.* Screens slide in and out over two full length cleaning brushes. Series A Screens can be interchanged with Screens. Exceptionally close screening is made possible by the variable speed of the screen shake, which is standard equipment on these Cleaners. Speed can be easily changed while the machine is in operation, enabling the operator to adjust the screening action to obtain accurate separation at greatest capacity on all conditions and varieties of seed, grain and beans. *Eight screens of the customers choice are included with each cleaner.* Additional screens are available from our large stock of perforated and wire screens.

SCREEN FRAMES — Screen frames rest on steel angle ways and are instantly fastened in place or released by full-length clamps on both edges of each screen. In addition to holding the screens in place, these clamps also prevent seed from running down edges or missing the screen surface.

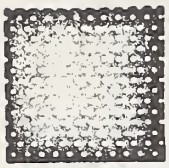
BRUSHES — Under each screen are two brushes carried on four rollers, with pre-lubricated bearings, *running on two tracks.* The fibres in these steel-back brushes are crimp-locked and form a solid brush the full length of each section. They cannot warp or sag away from the screens. Brushes are not disturbed when screens are changed — the only adjustment required is for the normal wear of the fibre. This adjustment can be made easily and quickly at any or all of the four track ends. All shafts are carried on ball bearings. Hardened steel roller chain on the crosshead pulls the two brushes under each screen. The wide screen clamps and simple method of brushcord adjustment eliminates plugging of the screens along the edges.

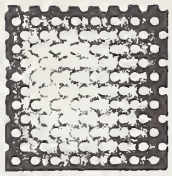
PATENTED AIR SEPARATION — The Air Separation System is patented *and should not be confused with other cleaners using the ordinary type of blower fans.* The many unique features of this system provide precise separation. The fan used on these models runs at constant speed. Air control and lift variations are easily made by turning a crank connected to a gate at the fan outlet. The air flow is equalized across the full width of the flue and is directed to a converging chamber built with an "S" turn. The turn directs the highest velocity of air flow to a point where the seed enters the separating chamber from the screening system. Heavy and light seed or grain are lifted into an expanding chamber for separation of light seed and foreign material from the heavier product of higher quality. The dust and lighter material removed by the air separation is carried to a release chamber. Here the lighter material separates from the dust and flows from a self-cleaning spout. Samples can be easily inspected for any adjustment of the air control to make the accurate separations that are possible with these cleaners.

SCREENINGS SPOUTS — Screenings spouts can deliver to *either the right side or to the left side when facing the machine from the front* where the screens are changed. All screenings spouts vibrate with the screens, and are inclined for complete self-cleaning Air discharge is toward the rear of the cleaner.

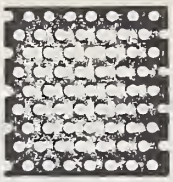
MOTORS — Seed Cleaners require low horsepower and can be furnished with either electric motors or gasoline engines. For quotation, specify cycle, phase, voltage, and type of motor or engine desired.

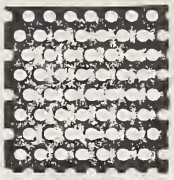
ROUND HOLES


1/25

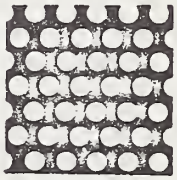

1/18 or 3½/64

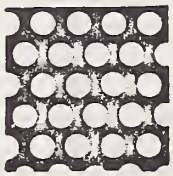

1/16 or 4/64


1/14 or 4½/64


1/12 or 5½/64

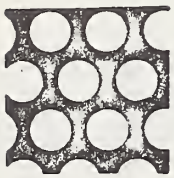

7/64


8/64 or 1/8


10/64


12/64 or 3/16


14/64


16/64 or 1/4


18/64

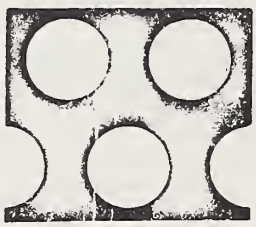

20/64 or 5/16


22/64 or 11/32


24/64 or 3/8


26/64


28/64


32/64 or 1/2

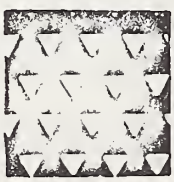

36/64

TRIANGLE HOLES


7/64 or 4½ V


8/64 or 5 V


9/64 or 5½ V


10/64 or 6 V


11/64 or 6½ V


12/64 or 7 V

OBLONG HOLES


3/64 x 5/16


3½x½ or 1/18 x ½


4 x ½ or 1/16 x½


4½x½ or 1/14 x ½


6 x ½ or 3/32 x ½


5½ x ¾ or 1/12 x ¾


6 x ¾ or 3/32 x ¾


3½ x ⅜ or 1/18 x ⅜


4⅞ x ¾


5 x ¾ or 1/13 x ¾


8 x ¾


9 x ¾


10 x ¾


12 x ¾


14 x ¾


16 x ¾


18 x ¾


5/16 x ¾


⅜ x ¾


½ x ¾

WIRE MESH